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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/691,136	10/21/2003	Ming Fang	42P17278	6592

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EXAMINER

BEREZNY, NEMA O

ART UNIT PAPER NUMBER

2813

DATE MAILED: 06/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/691,136

Applicant(s)

FANG ET AL.

AK

Examiner

Nema O Berezny

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 15-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-14, drawn to a method of making a semiconductor device, classified in class 438, subclass 108.
- II. Claims 15-30, drawn to a semiconductor device, classified in class 257, subclass 778.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the process as claimed can be used to make other and materially different product, such as a device without a waveguide.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Mike Bernadicou on 6-8-04 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-14. Affirmation of this election must be made by applicant in replying to this Office action. Claims 15-30 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kato et al. (5,394,490). Kato discloses a method, comprising: forming a die (Figs.1-2,16 el.1) with a surface; forming conductive bumps (el.4) on the surface of the die, the conductive bumps having a height equal or greater than the height of a waveguide (el.5; col.20 lines 14-18); forming a substrate (el.2); and bonding the conductive bumps to the substrate (col.7 line 64 – col.8 line 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-6, 9, and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato as applied to claim 1 above, and further in view of Brandenburg (5,770,477). Kato does not disclose the height of said conductive bumps, or forming said bumps via masking, or a fluxless soldering process, or the melting point of a bonding temperature of said bumps. Kato would look to one such as Brandenburg for multiple flip chip bonding because Kato discloses wherein the conductive bumps have a height greater than about 80 micrometers (col.3 lines 53-55) [**claim 3**]; wherein the conductive bumps have a height in a range from 80 micrometers to about 120 micrometers (col.3 lines 53-55) [**claim 4**]; and wherein the conductive bumps have a height in a range from 95 micrometers to about 110 micrometers (col.3 lines 53-55) [**claim 5**]. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the bump heights of Brandenburg with the method of Kato in order to allow another board and bumps to be bonded to a substrate in multiple flip chip bonding (col.3 lines 56-60).

Kato would look to one such as Brandenburg for fast mass fabrication of solder bumps because Brandenburg discloses wherein forming conductive bumps comprises:

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depositing a first conductive layer on a die; depositing a mask material layer on the thin conductive layer; pattern the mask material layer to form pad openings; depositing a second conductive layer in the pad openings of the patterned mask; and removing the mask material (col.3 lines 60-65), wherein the depositing and removing of a mask material is implied (col.3 lines 60-65). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the forming conductive bumps of Brandenburg with the method of Kato in order to fabricate a large number of solder bumps quickly **[claim 6]**.

Kato would look to one such as Brandenburg for precise bump positioning because Brandenburg discloses wherein bonding the conductive bumps to the substrate comprises bonding the conductive bumps to the substrate with a fluxless soldering process (col.3 lines 60-65). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the fluxless soldering of Brandenburg with the method of Kato in order to precisely deposit the solder wherein each bump will be accurately mated with a corresponding conductor after reflowing (col.3 line 66 – col.4 line 5) **[claim 9]**.

Kato would look to one such as Brandenburg for specific location bump reflow because Brandenburg discloses wherein the conductive bumps are bonded to the substrate at a bonding temperature and the conductive bumps have a melting point higher than the bonding temperature (col.3 lines 32-47) **[claim 12]**; wherein the bonding temperature is at least a melting point of a solder material that bonds the conductive bumps to the substrate (col.3 lines 32-47) **[claim 13]**; and wherein the bonding

temperature is about 230 degrees Celsius (col.3 lines 32-47) [**claim 14**]. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the different bump bonding temperatures of Brandenburg with the method of Kato in order to reflow some solder material without reflowing other areas (col.3 lines 32-47).

Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato in view of Brandenburg as applied to claims 1 and 6 above, and further in view of Berndlmaier et al. (5,059,553). Kato in view of Brandenburg do not disclose a protection layer or a barrier layer. Kato and Brandenburg would look to one such as Berndlmaier for oxidation and corrosion resistance because Berndlmaier discloses depositing a protection layer (Fig.2 el.44) on a conductive layer [**claim 7**]; and depositing a barrier layer (el.38; col.3 lines 54-65) between the protection layer and the conductive layer [**claim 8**]. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the protection and barrier layers of Berndlmaier with the method of Kato and Brandenburg in order to provide oxidation resistance and corrosion resistance, respectively.

Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato as applied to claim 1 above, and further in view of Pendse (2004/0070080). Kato does not disclose forming bumps on dies that are part of a wafer, or singulating said dies from said wafer. Kato would look to one such as Pendse economical mass

fabrication because Pendse discloses wherein the conductive bumps are formed on a plurality of dies that are part of a wafer (Fig.3 el.302) [**claim 10**]; and singulating the die from the wafer after forming the conductive bumps (p.5 para.56) [**claim 11**]. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the wafer forming and singulating of Pendse with the method of Kato in order to economically form a large plurality of dies on a wafer in one step, then singulating said dies from the wafer.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kato et al. (5,394,490). Kato does not disclose a height of a waveguide. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom other than fitting the waveguide between a flip chip die and a corresponding substrate, which Kato discloses. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O Berezny whose telephone number is (571) 272-1686. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NB


Chandra Chaudhari
Primary Examiner